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(54) Air laying to produce a board of non-uniform composition

(57) A method of manufacturing shaped bodies, in particular boards out of gypsum, water or hydration and comminuted fibers containing lignocellulose and/or cellulose is described in which all components are combined into a single starting mixture and at least one water saturated, ground-moist, light aggregate is dispersed in this mixture as a fixed pore former. From this starting mixture there is formed a mat which is built up symmetrically in cross-section by directing gas streams from opposite directions onto the mixture as it falls onto a moving belt wherein the light aggregates are located in the central layer. This mat which is built up symmetrically in cross-section is pressed while supplying heat. The aggregate is perlite, pumice or nemiculite and water soluble starch may be premixed with the gypsum to act as binder.

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A METHOD OF MANUFACTURING SHAPED BODIES, IN PARTICULAR BOARDS

The invention relates to a method of manufacturing shaped bodies, in particular boards from mixtures containing gypsum, water of hydration for the gypsum and comminuted fibers containing lignocellulose and/or cellulose, wherein a mat which can be pressed into shaped bodies is formed from the mixtures by means of scattering onto a moved substrate.

A method for the continuous manufacture of shaped bodies, in particular of boards is known from DE-OS 34 39 493 or its equivalent CA-PS 1,261,125 in which, in order to obtain higher board strengths, provision is made for splitting up at least one mass flow of a moistened gypsum fiber mixture into partial mass flows which are separate from one another, for scattering each partial mass flow to form a layer of a multi-layer shaped body onto a substrate or onto a proceeding layer, and for subsequently moistening, each scattered layer with water, with the quantity of water which is supplied to a shaped body being so dimensioned that it amounts to 25% more than the stochiometric quantity of water required for the curing of the gypsum-fiber mixture scattered to form the shaped body. A disadvantage is that the realisation of this method requires much complexity and effort and is thus expensive.

Moreover, one obtains in practice neither a satisfactory uniform moistening of the mat nor of the multi-layer shaped body that is obtained which negatively influences its homogeneity and surface quality.

In contrast the present invention is based on the object of providing a method of the initially named kind in accordance with which, qualitatively high value shaped bodies, in particular boards, can be manufactured in a particularly economical manner, even with a bulk density of ≤ 950 kg/m^3.

In accordance with the invention this object is satisfied in that a single starting mixture is formed from the mixtures which contains at least one water saturated, essentially ground-moist, light aggregate such as perlite and/or pumice and/or vermiculite and/or the like as a fixed pore former; in that the starting mixture is subjected as one string or flow to a single wind sifting scattering process executed on two sides, thereby forming a mat of symmetrical cross-section having three layers which merge into one another without steps; and in that a pressing of the mat is subsequently effected while supplying heat.

As a result of this method teaching the previous subdivision of at least one mass flow of a moistured gypsum/fiber mixture into partial mass flows which are separate from one another is first of all avoided since now a single string transport of the output mixture takes place, whereby a notable simplification and a reduction in the cost of the manufacturing effort is attained. The single wind sifting scattering process which is carried out on two sides in place of the known working with several separate scattering heads

contributes to this to a considerable degree.

In the scattering process of the invention, which is preferably carried out with an apparatus of the kind described in DE-PS 28 47 109, all the water saturated and essentially ground moist light aggregate particles in the starting mixture come together with a part of the gypsum and fiber particles present in the starting mixture exclusively in the central layer of the mat, which is a consequence of the weight increase which results through the water saturation. The covering layers of the mat are thus free of light aggregate particles. Through this and through the pressing of the mat with the supply of heat it is possible to manufacture boards, in particular boards with a bulk density of $\leq$ 950 kg/m^3, which moreover are characterised by dense smooth surfaces of high strength and a bending strength such that they can be used for wall constructions, non-load bearing partition walls, ceiling elements and other fields of application.

It has shown itself to be sensible to apply an additional quantity of water only to the surfaces of the two covering layers of the mat, since this measure leads during pressing of the mat to an increased bending strength of the resultant shaped body.

In accordance with another form of the method of the invention the starting mixture contains a strength increasing component such as for example water soluble starch. This component is preferably premixed with the gypsum in the dry state.

Further particularly advantageous embodiments of the method of the invention are set forth in the subordinate claims.

An embodiment of the invention will now be described in more detail in the following.

100 parts by weight of plaster of Paris in accordance with DIN 1168 were premixed with 5 parts by weight of water soluble starch in a dry state (mixture a)). At the same time the manufacture took place, on the one hand, of a mixture of 5 parts by weight of perlite (grain size $\geq$ 1 mm $\leq$ 3 mm) and 20 parts by weight of water (mixture b)) and, on the other hand, of a mixture of 15 parts by weight paper fibers and 20 parts by weight of water (mixture c)), with subsequent loosening up (fluffing). Thereupon the following events took place in sequence:

- Mixing of the starting mixture from the individual mixtures a), b) and c) - single string transport of the starting mixture to a scattering apparatus which operates by wind sifting, for example in accordance with DE-PS 28 47 109 - in the vicinity of this apparatus application of an additional quantity of water of 250 g/m^2 to each of the surfaces of the two covering layers of the mat - pressing of the mat at a press temperature of $\leq$ 60°C, a maximum press pressure of 10 bars and a press time of 60 seconds - drying of the boards that are obtained to a moisture content of $\leq$ 1%.

Under the above named process conditions of the invention 10 mm thick boards achieve a bulk density (kg/m^3) in the region of $\leq$ 950 and 1150 respectively and a bending strength (N/mm^2) in the region from $\geq$ 5.0 and 11.0 respectively (in dependence on the press pressure circa 7 bars or a maximum of 10 bars).

Patent Claims

1. A method of manufacturing shaped bodies, in particular boards from mixtures containing gypsum, water of hydration for the gypsum and comminuted fibers containing lignocellulose and/or cellulose, wherein a mat which can be pressed into shaped bodies is formed from the mixtures by means of scattering onto a moved substrate, characterised in that a single starting mixture is formed from the mixtures which contains at least one water saturated, essentially ground-moist, light aggregate such as perlite and/or pumice and/or vermiculite and/or the like as a fixed pore former; in that the starting mixture is subjected as one string or flow to a single wind sifting scattering process executed on two sides thereby forming a mat of symmetrical cross-section having three layers which merge into one another without steps; and in that a pressing of the mat is subsequently effected while supplying heat.

2. Method in accordance with claim 1, characterised in that the starting mixture contains a strength increasing component such as for example water soluble starch which is preferably premixed with the gypsum in a dry state.

3. Method in accordance with claim 1 or claim 2, characterised in that an additional quantity of water is only applied to the surfaces of the two covering layers of the mat that is formed.

4. Method in accordance with at least one of the preceding claims, characterised in that the starting mixture is formed of a mixture a), b) and c) wherein

- the mixture a) has 100 parts by weight of gypsum and ca. 3 to 8 parts by weight, preferably 5 parts by weight, of a strength increasing component such as water soluble starch or the like,

- the mixture b) has ca. 2 to ca. 10 and preferably 5 parts by weight of a pore former and a maximum of ca. 20 parts by weight of water, and

- the mixture c) has ca. 5 to ca. 30, particularly 15 parts by weight of fibres of lignocellulose and/or cellulose containing origin and ca. 15 to 20 parts by weight of water.

5. Method in accordance with claim 4, characterised in that first the mixture b) and then the mixture a) is added to the mixture c).

6. Method in accordance with claim 4 or claim 5, characterised in that the fibers in the mixture c) are loosened (fluffed) prior to the addition of the mixtures a) and b) into the mixture c).

7. Method in accordance with one or more of the preceding claims, characterised in that the additional quantity of water for the surfaces of the two covering layers of the mat amounts to at least 350 g/m^2.

8. Method in accordance with one or more of the preceding claims, characterised in that the mat is pressed at a press temperature of $\leq$ 60°C and at a press pressure of a maximum of 15 bars into a shaped body.

9. Method in accordance with one or more of the preceding claims, characterised in that the pressing of the mat takes place continuously and/or discontinuously.

10. Method substantially as herein described and explained with reference to the accompanying example.